



WEATHER CLIMATE WATER

WORLD
METEOROLOGICAL
ORGANIZATION



GLOBAL SEASONAL CLIMATE UPDATE

TARGET SEASON: June-July-August 2021

Issued: 26 May 2021



Canada



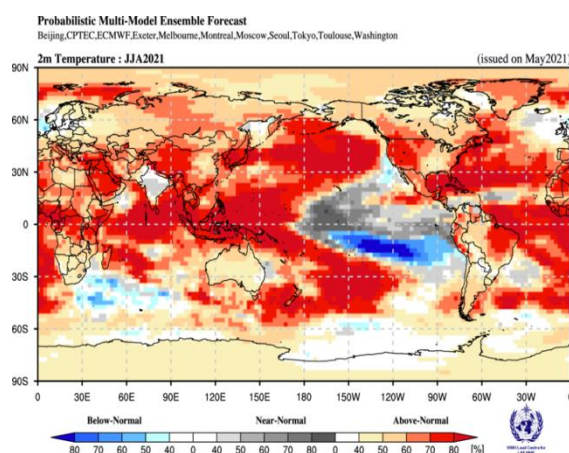
Summary

Observed sea surface temperatures (SSTs) in the central tropical Pacific were in a weak La Niña condition during February-April 2021. The Indian Ocean Dipole (IOD) remained in a near-neutral condition and is predicted to continue being neutral. The below-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions are predicted to return towards normal in the June-August 2021 season. Farther west in the Niño 4 region, the sea surface temperature anomaly is also predicted to weaken to near-zero. The June-August 2021 prediction, therefore, indicates a return to near-normal conditions in the central tropical Pacific.

Apart from a large area of the tropical eastern Pacific Ocean, sea-surface temperatures over most of the Pacific and Indian oceans are expected to be near or above-average for June-August 2021. Sea surface temperatures between about 30° and 60°N in the Pacific and Atlantic Oceans are also expected to be normal to above-normal, except over the North Sea. The continuing impacts of the 2020/21 La Niña are expected to diminish as La Niña returns to neutral, and the widespread warmer global sea-surface temperature anomalies more generally are predicted to dominate the forecast of air temperatures for June - August 2021. Air temperature anomalies over land are expected to be strongest in the Northern Hemisphere. Positive temperature anomalies are expected over almost the whole hemisphere, with the only notable exceptions in north-western Europe, south Asia, and the northern part of South America, extending into the southern Caribbean. The largest land air temperature anomalies are expected over the central western part of North America, and the far northern part of Asia, but there is also high consistency in the predictions of an anomalously warm June - August over the northern Caribbean, the Arabian Peninsula, part of central Asia, and far eastern Asia. In near-equatorial latitudes, positive temperature anomalies are predicted with high consistency in the Maritime subcontinent, along the south coast of West Africa, extending into central and eastern Africa and over eastern parts of South America. In the Southern Hemisphere, most of the land areas are predicted to have weak positive air temperature anomalies, but with the most notable exceptions of some of the Indian Ocean and South Pacific islands, model consistency is only moderate. Below-normal temperatures are predicted only for areas over the sea, including in the vicinity of the lingering La Niña, over the North Sea, and to the south of Madagascar.

The general weakness of predicted rainfall anomalies for June-August 2021 are typical of the absence of any strong sea-surface temperature anomalies in the tropical oceans. Nevertheless, there are some increased chances of unusually dry conditions in parts of the South Pacific and anomalously wet conditions to the west and south-west that are canonical impacts of the last phases of the latest La Niña. Along the equator across most of the Pacific Ocean, probabilities are highest for near-normal rainfall. Over the Caribbean there is a moderate to strong indication of below-normal rainfall, and a band of above-normal rainfall immediately to the south and just to the north of the equator. Increased chances of below-normal precipitation are also indicated over many parts of South America south of the equator, over much of the northern Mediterranean and surrounding areas, over parts of central and western North America, over parts of Central Africa, and over much of the east coast of Africa. Other areas of weakly increased probabilities for above-normal rainfall include some scattered locations in high latitudes of the northern hemisphere and in some parts of eastern and southern Asia.

Surface Air Temperature, JJA 2021



Precipitation, JJA 2021

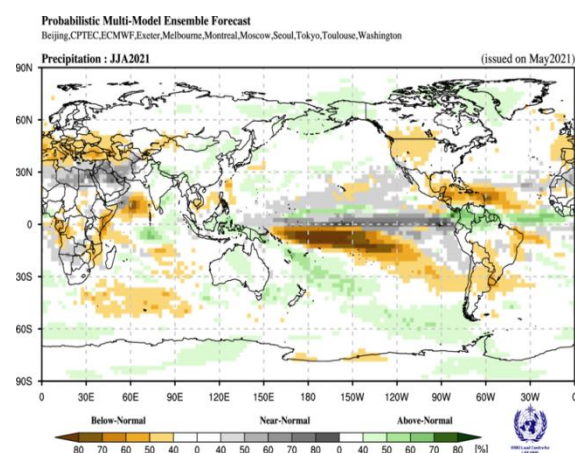


Figure 1. Probabilistic forecasts of surface air temperature and precipitation for the season June-August 2021. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in blue, red and grey shadings respectively for temperature, and orange, green and grey shadings respectively for precipitation. White areas indicate equal chances for all categories in both cases. The baseline period is 1993-2009.

1. Observations: February-April 2021

In the following sections, observed temperature and precipitation patterns for the period February-April 2021 are briefly described. For more detailed information about regional and local climate anomalies, the reader is referred to the concerned WMO Regional Climate Centres (RCCs) or RCC Networks, listed in Section 5.

1.1 Large-scale sea surface temperature (SST) indices

During February-March 2021, the four Niño sea surface temperature (SST) indices in the central and eastern Pacific were in negative territory, however, their amplitude declined from their stronger negative values during winter (for example, from December 2020-January 2021). The observed SST conditions characterized a decaying La Niña in the equatorial tropical Pacific. The Indian Ocean Dipole (IOD) over the observed period was near-zero. The North Tropical Atlantic (NTA) SST index was near-zero, and the South Tropical Atlantic (STA) SST index was weak negative.

| Month | Niño 1+2 | Niño 3 | Niño 4 | Niño 3.4 | IOD | NTA | STA |
|---------------------|----------|--------|--------|----------|------|------|------|
| February 2021 | -0.7 | -0.6 | -1.0 | -0.9 | 0.18 | 0.2 | -0.4 |
| March 2020 | -0.3 | -0.4 | -0.6 | -0.5 | 0.1 | 0.0 | -0.4 |
| April 2021 | -0.8 | -0.7 | -0.2 | -0.5 | 0.28 | -0.2 | -0.1 |
| February-April 2021 | -0.6 | -0.6 | -0.6 | -0.6 | 0.2 | 0.0 | -0.3 |

Table 1. Large-scale oceanic indices (°C). Anomalies are with respect to the 1981-2010 average. (Source: U.S. Climate Prediction Center)

1.2 Observed temperature

Over land, temperature anomalies across the globe continued their tendency of warmer-than-normal conditions for the season of February-April 2021 (Figure 2, top), and in general, above-normal temperatures dominated the global land areas. The most strongly positive land temperature anomalies occurred over the Arabian Peninsula, central and eastern Asia, and the northeast region of North America (including Greenland). Positive temperature anomalies also occurred over much of South America, the Indian subcontinent, and Africa. February-April 2021 also had notable regions with below-normal temperature anomalies including eastern Europe and north Asia, Australia, and north-western and central regions of North America.

Over the oceans, the eastern equatorial Pacific and southwest Indian Ocean (off the southeast coast of southern Africa) had cooler-than-normal temperatures. In the extratropical southern oceans near-to-below average temperatures generally prevailed. SSTs in the equatorial central Pacific indicated a weak La Niña condition, with positive anomalies in the western equatorial Pacific and negative anomalies in the central and eastern Pacific - a pattern that indicates enhanced zonal SST gradients across the equatorial Pacific. SST anomalies throughout the extratropical North Pacific and central Atlantic along 30°N were generally positive. A notable region having the largest observed warm ocean temperature anomaly was in the northeast Pacific.

Consistent with the seasonal mean anomalies, warm extremes dominated (Figure 2, bottom panel). Warm extremes (exceeding all seasonal mean temperatures observed during 1981-2010) occurred over southernmost South America and central Africa between equator and 15°S. No significant extreme cold temperature was found over land areas. Some oceanic regions also had warm extremes, notably sub-tropical northwest Pacific, extratropical northeast Pacific and north-western Atlantic off the coast of North America.

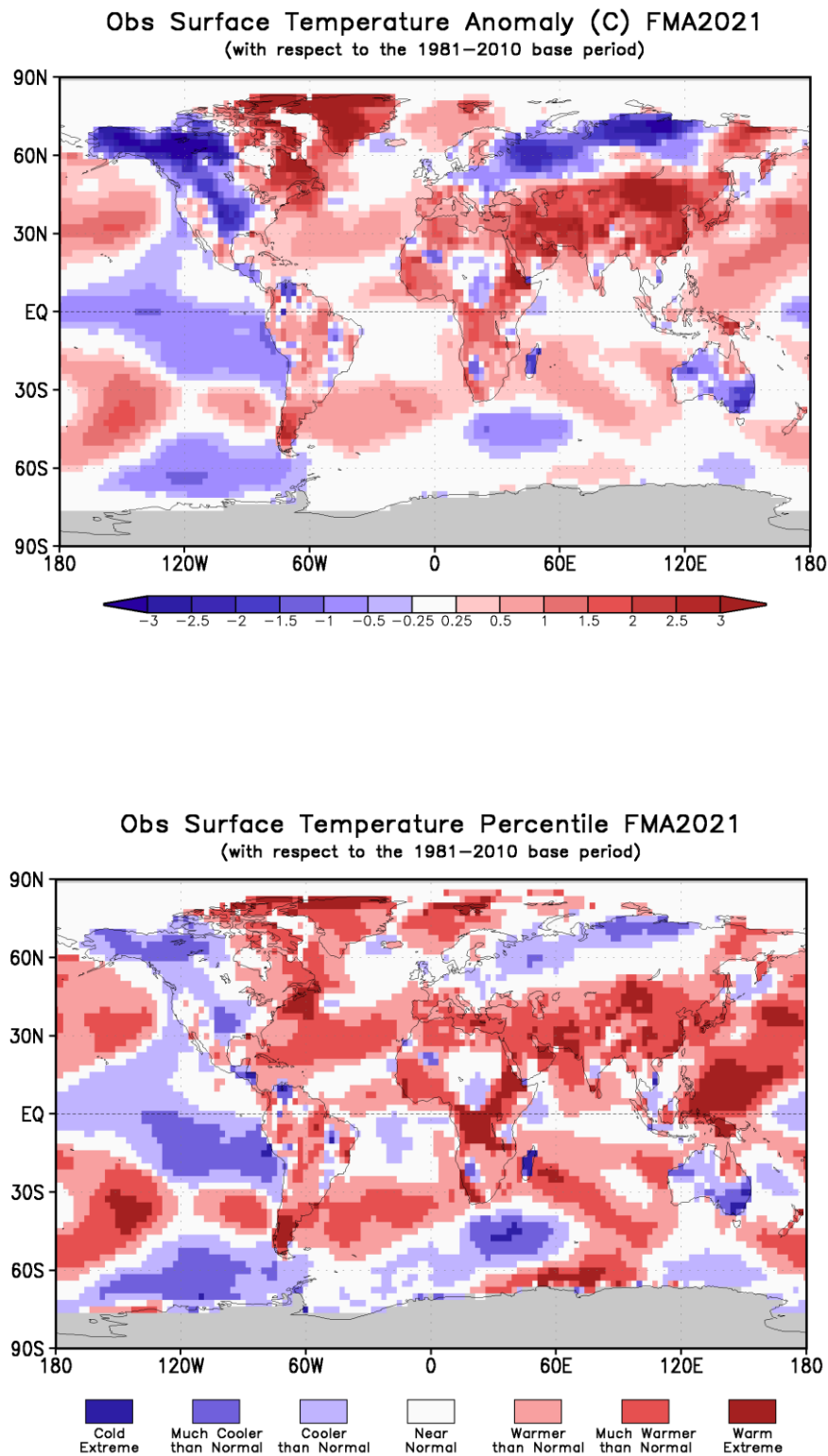


Figure 2. Observed February-April 2021 near-surface temperature anomalies relative to 1981-2010 (top). The *Cooler than Normal*, *Near Normal*, and *Warmer than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of the 1981-2010 distribution, respectively. Regions with anomalies in the lowest and highest decile (or 10%) of the distribution are marked as *Much Cooler than Normal* and *Much Warmer than Normal*, respectively. The *Cold Extreme* and *Warm Extreme* shadings indicate that the anomalies exceeded the coldest and warmest temperature values of the 1981-2010 period for the season. Grey shading indicates areas where observational analysis was not available. (Source: U.S. Climate Prediction Center).

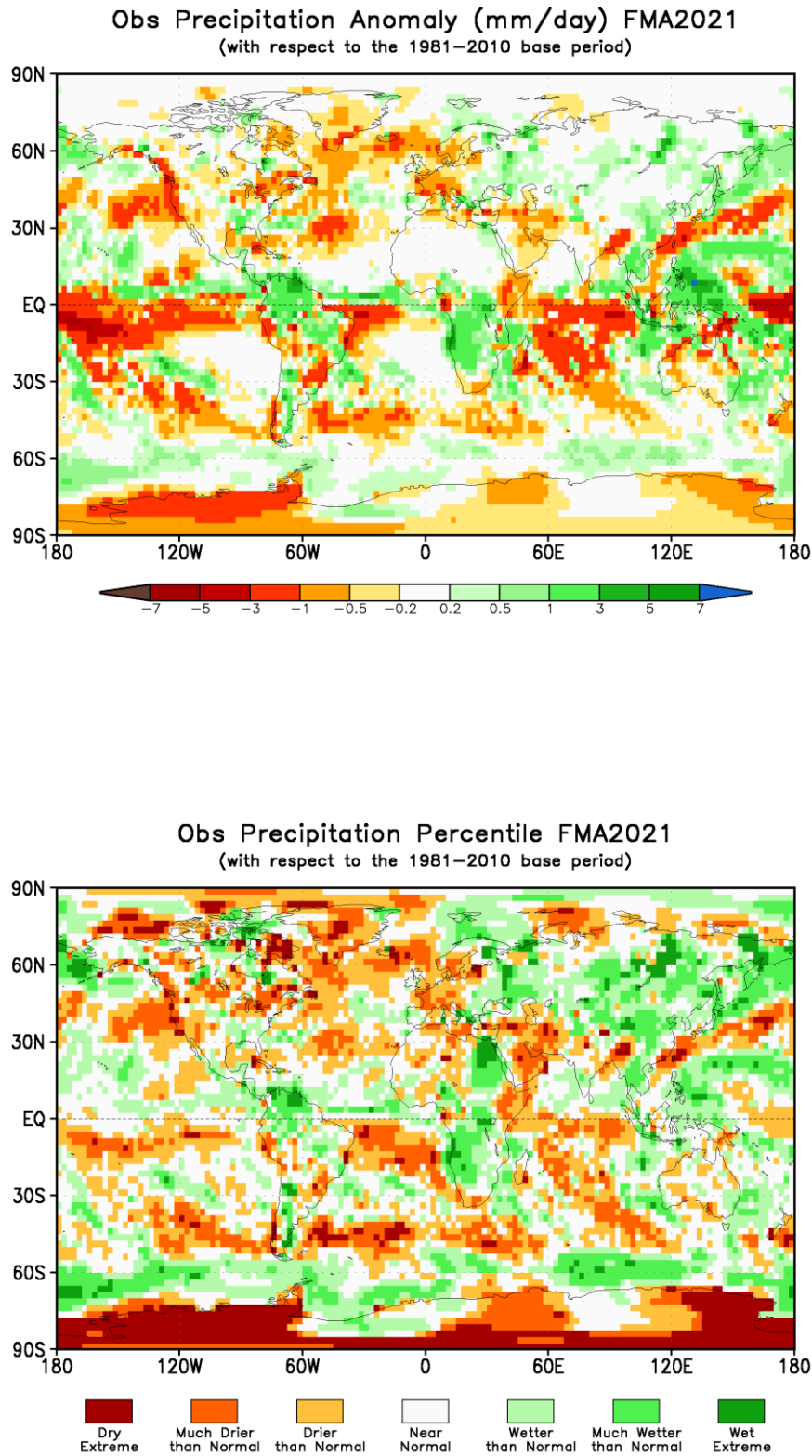


Figure 3. Observed precipitation anomalies for February–April 2021, relative to 1981–2010 base period (top). The *Drier than Normal*, *Near Normal* and *Wetter than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of the 1981–2010 distribution, respectively. Regions with anomalies in the lowest and highest decile (or 10%) of the distribution are marked as *Much Drier than Normal* and *Much Wetter than Normal*, respectively. The *Dry Extreme* and *Wet Extreme* shadings indicate that the anomalies exceeded the driest and wettest values of the 1981–2010 period for the season.

(Source: U.S. Climate Prediction Center).

1.3 Observed precipitation

For February-April 2021, the largest negative precipitation anomalies were in the equatorial Pacific near the date-line extending into the western Pacific with a narrower equatorial band extending into the eastern Pacific, a band extending into the southern Pacific towards South America, equatorial and southern Indian Ocean, and eastern region of equatorial Atlantic. Below-normal precipitation anomalies also occurred in the northwest Atlantic. West of the negative anomalies in the equatorial western Pacific, positive precipitation anomalies extended into the Indonesian Archipelago and sub-tropical western Pacific.

Below-normal precipitation anomalies generally dominated western coastal regions of North America, southern Greenland, and Arabian Peninsula. Precipitation was above-normal in central Africa, and northwest South America.

No large-scale systematic regions with dry or wet extremes (precipitation below or above all seasonal totals observed during 1981-2010) over land occurred.

2. Potential evolution of the state of the climate over the next three months (June-August 2021)

2.1 Large-scale SST-based indices, June-August 2021

| Month | Nino 1+2 | Nino 3 | Nino 4 | Nino3.4 | IOD | NTA | STA |
|-------------------------|----------|---------|----------|----------|----------|---------|---------|
| June 2021 | 0.0±0.3 | 0.0±0.2 | 0.0±0.1 | -0.1±0.1 | -0.1±0.3 | 0.2±0.2 | 0.1±0.1 |
| July 2021 | 0.2±0.3 | 0.1±0.3 | -0.1±0.2 | -0.1±0.2 | -0.1±0.3 | 0.3±0.2 | 0.1±0.1 |
| August 2021 | 0.2±0.3 | 0.6±0.3 | -0.1±0.2 | -0.1±0.3 | -0.2±0.3 | 0.3±0.2 | 0.2±0.1 |
| June-August 2021 | 0.1±0.3 | 0.1±0.3 | -0.1±0.2 | -0.1±0.2 | -0.1±0.3 | 0.2±0.2 | 0.2±0.1 |

Table 2: Multi-model forecasts for oceanic indices (°C), with standard deviation. Values are the equal-member-weighting average of those derived, using each GPC models own hindcast climate mean, from the GPCs supplying SST forecasts (GPC CPTEC, ECMWF, Exeter, Melbourne, Montreal, Moscow, Offenbach, Seoul, Tokyo, Toulouse, Washington). The standard deviation is calculated on all ensemble members. The latitude/longitude bounds of the regions are given in the supplementary information section.

Observed sea surface temperatures in the central tropical Pacific were in the last stages of La Niña conditions during February - April 2021. The below-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions are predicted to be close to zero reaching values of approximately -0.1°C (Niño 3.4) and 0.1 (Niño 3) during the June-August 2021 season. Farther west in the Niño 4 region, the sea surface temperature anomaly is also predicted to be close to zero, with a value of about -0.1°C. The JJA 2021 prediction, therefore, indicates a return to near-normal conditions in the central tropical Pacific. The IOD is predicted to be close to zero over the three months JJA 2021. In the equatorial Atlantic, SSTs are predicted to be slightly above average in both the northern (NTA) and the southern (STA) areas during the season.

2.2 Predicted temperature, June-August 2021

For information on the construction of the multi-model forecast maps refer to the supplementary information section. (Note: Maps indicating forecast consistency among GPC models are available in the supplementary information¹).

¹ File with supplementary information can be downloaded from https://ftp.cpc.ncep.noaa.gov/mingyue/GSCUWMO/Forecasts/GSCU_JJA2021_supplementary_info_LC-LRFMME.docx

Probabilistic Multi-Model Ensemble Forecast

Beijing, CPTEC, ECMWF, Exeter, Melbourne, Montreal, Moscow, Seoul, Tokyo, Toulouse, Washington

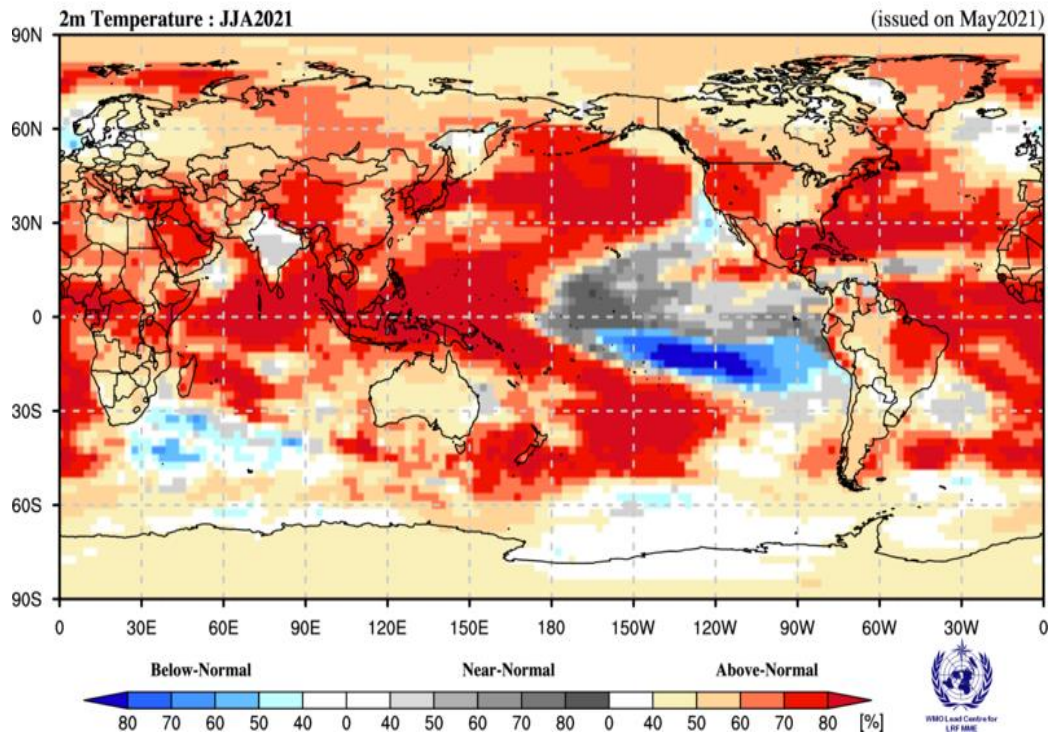


Figure 4. Probabilistic forecasts of surface air temperature for June-August 2021. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in blue, red and grey shadings respectively. White areas indicate equal chances for all categories in both cases. The baseline period is 1993-2009. Figure is generated by The WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble.

The continuing impacts of the 2020/21 La Niña are expected to diminish as La Niña returns to neutral, and the widespread warmer global sea-surface temperature anomalies more generally are predicted to dominate the forecast of air temperatures for June - August 2021. Air temperature anomalies over land are expected to be strongest in the Northern Hemisphere. Positive temperature anomalies are expected over almost the whole hemisphere, with the only notable exceptions in north-western Europe, south Asia, and the northern part of South America, extending into the southern Caribbean. The largest land air temperature anomalies are expected over the central western part of North America, and the far northern part of Asia. The models are most consistent in their predictions of an anomalously warm June - August 2021 over the said part of North America. Consistency is also high over the northern Caribbean, the Arabian Peninsula, part of central Asia, and far eastern Asia, although the predicted positive anomalies are not as high in these areas. In near-equatorial latitudes, positive temperature anomalies are predicted with high consistency in the Maritime subcontinent, along the south coast of West Africa, extending into central and eastern Africa and over eastern parts of South America. In the Southern Hemisphere, most of the land areas are predicted to have weak positive air temperature anomalies, but with the most notable exceptions of some of the Indian Ocean and South Pacific islands, model consistency is only moderate. Below-normal temperatures are predicted only for areas in the vicinity of the lingering La Niña, and in small areas over the sea, including to the south of Madagascar, the North Sea, near the west coast of North America, and in a few areas along about 60°S.

RA I (Africa): Enhanced probabilities of above-normal temperature are indicated over of the whole of mainland Africa plus Madagascar. Probabilities are strongest in western North Africa, and in near equatorial regions extending from the south coast of West Africa through to the Greater Horn. Southern Africa experiences its winter season during June-August, and probabilities of above-normal temperature here are weaker than for most of the rest of the continent, but still increased. Model-to-model consistency is moderate to high over the entire continent.

RA II (Asia): Enhanced probabilities for above-normal temperature are indicated over the whole of Asia, except for the south Asian peninsula, where near-normal temperatures are the most likely outcome. The probabilities for above-normal temperature are highest over the Arabian Peninsula, the maritime continent and south-east Asia, the far parts of east Asia, and along about 90°E north of the Himalayas. Model-to-model consistency for these same regions is moderate to high, although there is little agreement about the signal over the south Asian peninsula.

RA III (South America): Enhanced probabilities for above-normal temperature are indicated over most of South America. The increases in probability are largest over the north-eastern part of the subcontinent, and along a narrow band over the Andes north of about 15°N. The level of model consistency is moderate to strong over most areas and is particularly strong south of about 30 °S. This same area experienced an unusually warm February-April. Immediately to the north of 30°S there is a small area west of the Andes where model consistency is weak, and there is no clear signal in the air temperature. Over the far northern part of South America, there are increased probabilities of near-normal and above-normal temperature.

RA IV (North America, Central America and the Caribbean): There are enhanced probabilities for above-normal temperature over all of North America as well as over Central America and the Caribbean north of about 15°N. South of 15°N there are increased probabilities of near-normal to above-normal temperatures. The probabilities for above-normal are highest over much of the western half of North America and over the northern part of the Caribbean and neighbouring areas of Central America, but in the far north-eastern part of South America the increase in probabilities for above-normal temperature is weak. Model-to-model consistency is high over most of the region except for the southernmost areas, and also in some parts of the Arctic; in both these areas consistency is moderate.

RA V (Southwest Pacific): Strongly enhanced probabilities for above-normal temperature are predicted in a band from north of Australia, extending to the central South Pacific, and along about 40 °S from New Zealand towards the eastern Pacific to about 120 °W. The Indonesian Archipelago and many of the southwest Pacific islands, lie within this band of above-normal temperatures, and model-to-model consistency is strong over most of the area. There is a sharp transition to an area of predicted below-normal temperature to the northeast, which closely represents the distribution of predicted negative sea-surface temperature anomalies associated with the decaying La Niña conditions. Model-to-model consistency in this cold area is strong. Over most of Australia, there are weakly enhanced probabilities of above-normal temperature with weak consistency in the temperature predictions. Over the east coast of Australia there is an area of increased probability of near-normal temperature with weak model consistency.

RA VI (Europe): The probabilities for above-normal temperature are increased over most of Europe, but not as strongly for much of the rest of the northern hemisphere. Probabilities are highest and model-to-model consistency strongest in southern Europe, and also over Greenland. Over other parts of north-western Europe and extending along about 60°N into eastern Europe, there is a weak indication of increased probabilities of below-normal temperature, but model-to-model consistency is mostly weak to moderate.

2.3 Predicted precipitation, June-August 2021

Probabilistic Multi-Model Ensemble Forecast

Beijing, CPTEC, ECMWF, Exeter, Melbourne, Montreal, Moscow, Seoul, Tokyo, Toulouse, Washington

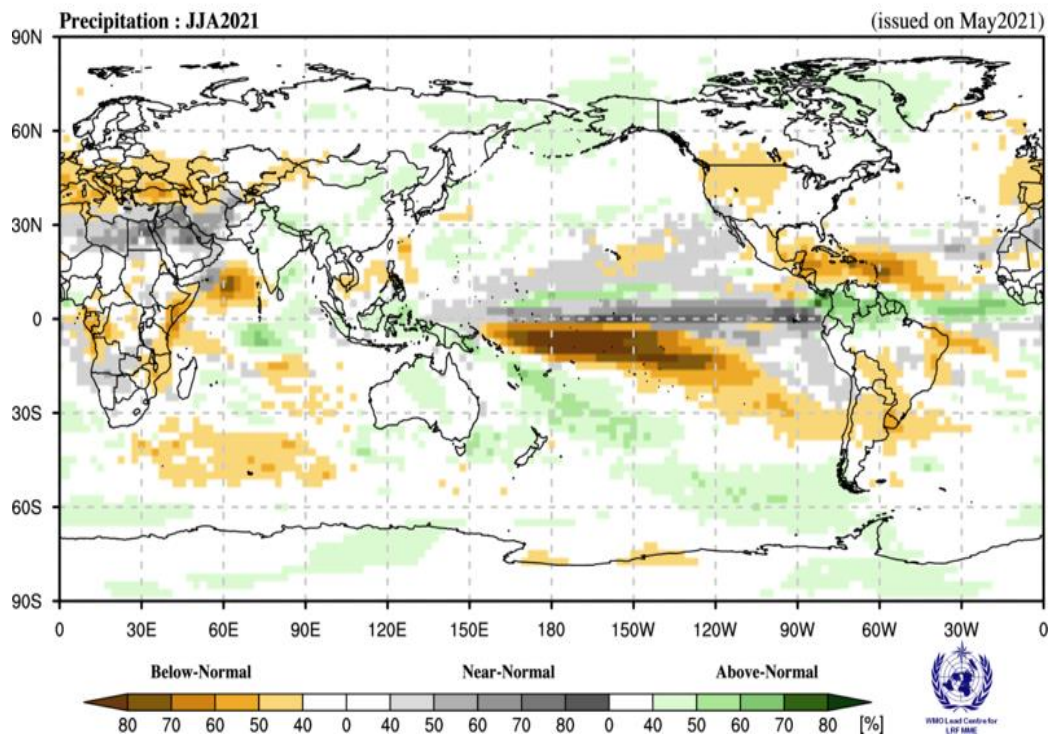


Figure 5. Probabilistic forecasts of precipitation for the season for June-August 2021. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in orange, green and grey shadings respectively. White areas indicate equal chances for all categories in both cases.

The baseline period is 1993-2009. Figure is generated by The WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble.

The general weakness of predicted rainfall anomalies for June-August 2021 are typical of the absence of any strong sea-surface temperature anomalies in the tropical oceans. Nevertheless, there are some increased chances of unusually dry conditions in parts of the South Pacific and anomalously wet conditions to the west and south-west that are canonical impacts of the last phases of the latest La Niña. Along the equator across most of the Pacific Ocean, probabilities are highest for near-normal rainfall. Over the Caribbean there is a moderate to strong indication of below-normal rainfall, and a band of above-normal rainfall immediately to the south and just to the north of the equator. Increased chances of below-normal precipitation are also indicated over many parts of South America south of the equator, over much of the northern Mediterranean and surrounding areas, over parts of central and western North America, over parts of Central Africa, and over much of the east coast of Africa. Other areas of weakly increased probabilities for above-normal rainfall include some scattered locations in high latitudes of the northern hemisphere and in some parts of eastern and southern Asia.

RA I (Africa): Enhanced probabilities for below-normal precipitation are predicted over much of the far eastern part of Africa, most notably near the equator, over parts of Central Africa below the equator, and over the far north-western part of North Africa. Model-to-model consistency is moderate to strong over most of these areas. Over much of the rest of Africa north of about 20°N and in central and western parts of southern Africa, the forecast indicates increased probabilities for near-normal rainfall, but most of these areas are desert and/or experiencing their dry season. The southern coast of West Africa is indicated to have weakly increased chances of above-normal rainfall, but the model-to-model consistency for this signal is low.

RA II (Asia): There are few indications of large-scale shifts in probability of rainfall anywhere over Asia. In the far south-western part of the continent, there are some indications of increased probabilities for near-normal or below-normal rainfall, but these areas are dry at this time of year anyway. Over much of the eastern half and southern parts there are patchy areas of enhanced probability for above-normal precipitation, but model-to-model consistency is generally weak. There are weak indications of increased probabilities for below-normal rainfall in an area extending from the far south-east mainland, eastward to the Philippines, and then northward to the southern part of Japan, but again, consistency is mostly weak.

RA III (South America): Most of South America along and north of the equator, except for the northernmost coast, is predicted to have above-normal rainfall (model-to-model consistency is mostly moderate strong). In the very far southern part of South America there is a small increase in probability of above-normal, but model consistency is strong. Over much of the rest of South America there is a weak tilt towards below-normal rainfall and model-to-model consistency is low. The forecast in the northern area represents a continuation of above-normal conditions as observed there in February - April 2021.

RA IV (North America, Central America and the Caribbean): An enhanced probability for below-normal precipitation is predicted for much of the Caribbean and for Central America bordering the Gulf of Mexico and Caribbean Sea, with moderate to high model consistency. There are also indications for below-normal precipitation over western and central parts of North America, which in many cases represent a continuation of an anomalously dry February - April 2021. Model-to-model consistency is moderate to strong in this area. In the far northeast and northwestern parts of North America, there are slightly increased chances of above-normal rainfall and model consistency is moderate.

RA V (Southwest Pacific): Probabilities for above-normal rainfall are weakly enhanced over an area extending from equatorial parts of the maritime continent into the Southwest Pacific to an area northeast of New Zealand, with a second branch extending from New Zealand towards the south-easternmost tip of Australia. The model consistency strengthens towards the southeast of this band. There is a second band of weakly enhanced probabilities for above-normal rainfall extending inland from the north-western coast of Australia. Over the central Pacific there is an area of strongly increased probabilities for below-normal rainfall that is immediately south of the equator. This area extends from about 170°E and extends towards the southeast reaching as far as South America, but the probabilities weaken east of about 120°W. Model-to-model consistency is strong throughout most of this region. Along the equator across most of the Pacific Ocean, probabilities are highest for near-normal rainfall.

RA VI (Europe): Over much of Europe south of about 50 °N there is an increased chance of below-normal precipitation. Model-to-model consistency is high. Elsewhere there is no consistent signal in the predicted precipitation.

3. Latest updates for monitoring and prediction information

Each month, the latest updates for the real-time monitoring and seasonal mean predictions included in GSCU can be found at:

Monitoring:

<https://ftp.cpc.ncep.noaa.gov/mingyue/GSCUWMO/>

Predictions:

www.wmolc.org/board/downloadExt?fn=WMOLC_T2M.png

http://www.wmolc.org/board/downloadExt?fn=WMOLC_PREC.png

4. How to use the Global Seasonal Climate Update

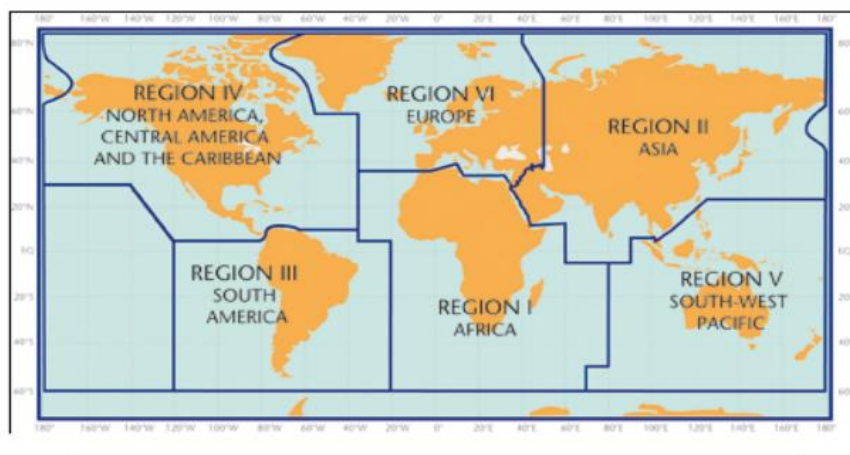
The GSCU is intended as guidance for RCCs, Regional Climate Outlook Forums (RCOFs) and National Meteorological and Hydrological Services (NMHSs). It does not constitute an official forecast for any region or nation. Seasonal outlooks for any region or nation should be obtained from the relevant RCCs (see below for contact details) or NMHS.

Seasonal forecasts are probabilistic in nature. Although the text and figures used in the GSCU highlight the tercile categories that is predicted with the highest probability, it is important to recognize that the other tercile categories may also have substantial (though lower) probability.

The geographical areas occupied by the forecast signals should not be considered precise. Similarly, signals with small spatial extent may be unreliable.

The skill of seasonal forecasts is substantially lower than that of weather timescales and skill may vary considerably with region and season. It is important to view the forecast maps together with the skill maps provided in the supplementary appendices.

For reference, the six WMO Regional Associations domains are depicted in the figure below.



5. Designated and developing WMO Regional Climate Centres and Regional Climate Centre Networks

- <https://public.wmo.int/en/our-mandate/climate/regional-climate-centres>

6. Resources

Sources for the graphics used in the GSCU:

- The WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble (LC-LRFMME):
<http://www.wmolc.org>
- WMO portal to the Global Producing Centres for Long-range Forecasts (GPCs-LRF):
http://www.wmo.int/pages/prog/wcp/wcasp/clips/producers_forecasts.html
- WMO portal for Regional Climate Outlook Forums
<https://public.wmo.int/en/our-mandate/climate/regional-climate-outlook-products>
- International Research Institute for Climate and Society (IRI):
<http://portal.iri.columbia.edu/portal/server.pt>
- NOAA Climate Prediction Centre (CPC):
<http://www.cpc.ncep.noaa.gov>

7. Acknowledgements

This Global Seasonal Climate Update was jointly developed by the WMO Commission for Climatology and Commission for Basic Systems with contributions from:

- WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble (LC-LRFMME), Korea Meteorological Administration, NOAA National Centers for Environmental Prediction
- WMO Global Producing Centres for Long-Range Forecast (GPCs-LRF): GPC-Beijing (China Meteorological Administration), GPC-CPTEC (Center for Weather and Climate Studies, Brazil), GPC-ECMWF (European Center for Medium-Range Forecast), GPC-Exeter (UK Met Office), GPC- Melbourne (Bureau of Meteorology), GPC- Montreal (Meteorological Services of Canada), GPC-Moscow (Hydro meteorological Center of Russia), GPC- Offenbach Deutscher Wetterdienst), GPC-Pretoria (South African Weather Services), GPC-Seoul (Korea Meteorological Administration), GPC-Tokyo (Japan Meteorological Agency), GPC-Toulouse (Météo-France), GPC-Washington (National Centers for Environmental Prediction)
- International Research Institute for Climate and Society (IRI)